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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,606	07/19/2006	Yasuhiro Toida	8062-1039	5951

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YOUNG & THOMPSON
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EXAMINER

ROBINSON, RENEE E

ART UNIT	PAPER NUMBER
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1774

NOTIFICATION DATE	DELIVERY MODE
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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

DocketingDept@young-thompson.com

Office Action Summary	Application No. 10/586,606	Applicant(s) TOIDA, YASUHIRO	
	Examiner RENEE ROBINSON	Art Unit 1774	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 July 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4,9,11,12,14-19 and 21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,9,11,12,14-19 and 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 19 July 2010 has been entered.

Response to Amendment

2. Amendment to claims 1-4, 11, 14, 18 and 19; cancellation of claim 13; and addition of new claim 21 is noted.
3. Due to amendments to the claims, the previous rejection has been modified. Examiner's response to the arguments follows the rejection.

Claim Objections

4. Claim 3 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 3 includes the limitation wherein the reaction products are adsorbed by the zeolite *and/or* the solid

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superacid catalyst, which supports an embodiment wherein the reaction products are adsorbed by the zeolite and not necessarily the solid superacid catalyst. However, given that claim 1 requires adsorption by the solid superacid catalyst, this embodiment does not limit the scope of claim 1.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claim 21 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Specifically, the limitation "bringing the sulfur compounds into contact with the superacid catalyst in the absence of hydrogen for the adsorption desulfurization" introduces new matter to the claims. The specification as originally filed does not adequately support this limitation. The specification mentions treatment in the absence of hydrogen for the embodiment using activated carbon (p. 14, [0032]), but does not specifically disclose an embodiment using the solid superacid catalyst wherein the process occurs in the absence of hydrogen.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 1-4, 9, 11, 12, 14, 18 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. Regarding claim 1, the limitation “wherein desulfurization occurs by the sulfur compounds reacting among themselves and/or with aromatic hydrocarbons followed by adsorption desulfurization by bringing the sulfur compounds into contact with the superacid catalyst for the adsorption desulfurization after the reaction among sulfur compounds among sulfur compounds themselves or the reaction of sulfur compounds with the aromatic hydrocarbons” is unclear. It is unclear whether the limitation is intending to convey that (1) upon contacting the kerosene or gas oil with the solid superacid catalyst, the reaction between the sulfur compounds themselves or between the sulfur compounds and the aromatic hydrocarbons occurs prior to adsorption of the reaction products by the solid superacid catalyst, or (2) the reaction of the sulfur compounds between themselves and/or with aromatic hydrocarbons occurs prior to contact with the solid superacid catalyst and, after the reaction takes place, the kerosene or gas oil is brought into contact with the solid superacid catalyst for adsorption of the sulfur compounds. For the purposes of examination, examiner has taken interpreted meaning (1) to be the intended claim limitation.

10. In addition, examiner respectfully points out that if, on the contrary, meaning (2) is intended, the claim would be rejected under 35 USC 112, first and second paragraphs. Regarding 35 USC 112, second paragraph, this meaning would be unclear because it would appear to contradict prior steps in claim 1, which state that reaction

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occurs by brining the kerosene or gas oil into contact with the solid superacid catalyst. Regarding 35 USC 112, first paragraph, the limitation would be considered to introduce new matter to the claimed invention, as such an embodiment is not supported by the specification as originally filed. The specification clearly states that the solid superacid catalyst *catalyzes the reaction between the sulfur compounds themselves and between the sulfur compounds and the aromatic compounds* (see, for example, third paragraph under [0005]) and further states that "the product produced by the reaction catalyzed by the solid acid catalyst may be adsorbed by the solid acid catalyst itself or may be adsorbed by one or more other adsorbents" (see [0037]) and thus is not considered to support an embodiment wherein the kerosene or gas oil are brought into contact with a solid acid catalyst *after* reaction of the sulfur compounds.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

13. Claims 1-4, 9, 11, 12 and 14-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toida (WO 2003/097771) in view of Imura et al (EP 1 142 636).

Hereinafter, the WIPO document (Toida) is cited from the English translation, US 2005/0173297.

14. Regarding claims 1-3 and 9, Toida discloses a method for desulfurizing kerosene or gas oil comprising reacting sulfur compounds in a kerosene or gas oil containing aromatic hydrocarbons and at least one sulfur compound selected from the group consisting of thiophene compounds, benzothiophene compounds, and dibenzothiophene compounds among themselves and/or with aromatic hydrocarbons by bringing the kerosene or gas oil into contact with a solid acid catalyst (zeolite) and thereafter the sulfur compounds and reaction products are adsorbed onto the zeolite (see [0012]; [0014]; [0018]; [0088]; [0094]).

15. Toida does not explicitly disclose a solid superacid catalyst and therefore also does not disclose a solid superacid catalyst having a specific surface area of 100 m²/g or more, as per claim 9.

16. Imura teaches desulfurizing a light hydrocarbon oil by contacting the hydrocarbon oil with a superstrong acid catalyst comprising zirconium oxide (zirconia) and from 1 to 3 wt% sulfuric acid radicals (i.e. SO₄ or sulfate) (Abstract; p. 3, par. 0012 and 0017).

Imura discloses examples in which the specific surface area of the catalyst is greater than 100 m²/g (see Table 1). Imura teaches that the disclosed solid acid catalyst has activity in both hydrocarbon isomerization and desulfurization of organosulfur compounds, wherein isomerization of the hydrocarbon oil improves the octane number of the fuel, thereby improving engine performance in motor vehicles and aircraft (p. 2,

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17. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the process of Toida by using a solid acid catalyst comprising a sulfated zirconia with a specific surface area of greater than $100 \text{ m}^2/\text{g}$, as suggested by Imura, in order to provide both isomerization and desulfurization capabilities, thereby providing a fuel with a lower sulfur content and an improved octane number.

18. Examiner acknowledges that Imura teaches desulfurizing a light hydrocarbon oil, such as light naphtha from, for example, distillation of crude oil (see [0034]). However, given that naphtha is generally only one cut lighter than kerosene or gas oil in the distillation of crude oil, it is reasonable to conclude that a person of ordinary skill in the art would try by routine experimentation utilizing the sulfated zirconia of Imura in the process of Toida, wherein the feedstock is kerosene or gas oil, with a reasonable expectation of success, especially given that Toida suggests adsorptive desulfurization of gasoline (naphtha), kerosene, and gas oil (see [0094]).

19. Furthermore, like Toida, Imura discloses that the catalyst is suitable for removing thiophene compounds (see p. 6, par. 0043-0045). Therefore, in modifying Toida with Imura, the solid superacid catalyst would be expected to contribute to the adsorption of the sulfur compounds in the hydrocarbon oil and the heavy sulfur compounds produced by the reaction of the sulfur compounds with themselves and with the aromatic compounds. Accordingly, the limitations of claim 1 are not considered to patentably distinguish the instant process from Toida in view of Imura.

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20. Further regarding claims 1-3, Toida discloses wherein the zeolite is selected from the group consisting of proton-type faujasite zeolite, proton-type mordenite, and proton-type β -zeolite, and having a silica/alumina ratio of less than 100 mol/mol (i.e. not more than 10 mol/mol for faujasite and not more than 20 mol/mol for mordenite) (see [0084]-[0086]).

21. Toida does not expressly disclose that the content of cations other than proton in the faujasite zeolite, mordenite, and β -zeolite is 5 mass% or less. However, Toida teaches that the amount of protons in the solid acid zeolite affects the molar ratio of $\text{SiO}_2/\text{AlO}_4$, the acid strength, and the solid acid amount (see [0085]). Therefore, the exact content of protons of the solid acid zeolite component is deemed to be a result effective variable with regard to the molar ratio of $\text{SiO}_2/\text{AlO}_4$, the acid strength, and the solid acid amount. It would require routine experimentation to determine the optimum value of a result effective variable, such as the exact content of protons, in the absence of a showing of criticality in the claimed proton (or cation) content. *In re Boesch*, 205 USPQ 215 (CCPA 1980), *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). One of ordinary skill in the art would have been motivated by Toida to optimize the content of protons in the solid acid zeolite in order to provide an adsorptive desulfurization agent which provides the maximum adsorption of undesirable sulfur compounds.

22. Regarding claims 4, 18 and 19, Toida teaches reducing the sulfur content of the kerosene or gas oil to 1 ppm or less (not more than 1 ppm) ([0119]).

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23. Regarding claim 11, Toida discloses that the kerosene or gas oil contains aromatic hydrocarbons as major components ([0006]-[0007]; [0019]; [0088]; Table 4).

24. Regarding claim 12, Toida discloses that the aromatic hydrocarbons include toluene (alkylbenzene having 7 carbon atoms) and aromatic compounds with two rings (naphthalene) (p. 2, par. 0019; p. 7, par. 0088).

25. Regarding claim 14, Toida teaches that the kerosene and gas oil may be demanded as a result of the widespread use of the fuel cell for automobiles or the like which carry the fuel cell of the onboard reforming type (p. 1, par. 0002; p. 8, par. 0094). Therefore, while Toida does not expressly disclose that the kerosene or gas oil is desulfurized in the fuel cell vehicle, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to implement the desulfurization process of Toida in a fuel cell vehicle as claimed since Toida expressly suggests the high demand for low sulfur fuel for onboard reforming fuel cells.

Response to Arguments

26. Applicant's arguments filed 19 July 2010 have been fully considered but they are not persuasive.

27. Applicant traversed the 35 USC 112, first paragraph, rejection by arguing that even if the absence of hydrogen is not explicitly mentioned in relation with the solid superacid catalyst, it is clear to one skilled in the art that if the reaction is carried out in the presence of hydrogen, the sulfur compounds and hydrogen react to produce hydrogen sulfide before they react among themselves and/or with aromatic

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hydrocarbons. Thus, applicant submits that one skilled in the art surely knows that the reaction would be carried out in the absence of hydrogen in order to avoid the problems created by hydrogen.

28. This argument is not found persuasive. Examiner appreciates that applicant need not explicitly discuss an inherent function or property associated with the invention.

However, “to establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). Applicant's arguments do not appear to establish the absence of hydrogen as an inherent characteristic of the claimed invention. For example, applicant states that “it is clear to one skilled in the art that if the reaction is carried out in the presence of hydrogen, *the sulfur compounds and hydrogen react to produce hydrogen sulfide before they react among themselves and/or with aromatic hydrocarbons*” (*emphasis added*). While this may be true, it does not necessarily require the complete absence of hydrogen. It would reasonably be expected that the reaction claimed and adequately described in the instant invention, i.e. the sulfur compounds between themselves and/or with aromatic hydrocarbons, could still occur in the presence of low concentrations of hydrogen, wherein after the hydrogen is consumed for reaction, the sulfur compounds would thereafter react according the instant claims. Thus, since the specification as originally filed does not sufficiently

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describe the process occurring in the absence of hydrogen, including this limitation into the amended claims is considered to introduce new matter to the claimed invention.

29. Applicant argues that Imura clearly states that the sulfur compounds undergo hydrogenolysis simultaneously with feedstock oil isomerization so that desulfurization can be conducted, wherein the sulfur compounds in the instant claimed process undergo reaction with themselves and/or with aromatic hydrocarbons. Thus, the reaction mechanism of desulfurization is different between the present invention and that of Imura's.

30. This argument is not found persuasive. First, the process of claims 1-4, 9, 11, 12 and 14-19 do not exclude the possibility of the presence of hydrogen, as interpreted by the transitional phrase "comprising". The transitional term "comprising", which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. See, e.g., *Mars Inc. v. H.J. Heinz Co.*, 377 F.3d 1369, 1376, 71 USPQ2d 1837, 1843 (Fed. Cir. 2004). Second, Imura was relied upon for modifying the process of Toida, wherein desulfurization occurs by adsorption of the sulfur compounds. In modifying Toida with Imura, a person of ordinary skill in the art would optimize by routine experimentation the operating conditions, including hydrogen concentration, to maximize desulfurization of the feedstream. As discussed above, at lower concentrations of hydrogen, it is reasonably expected that the claimed reactions will occur, i.e. the reaction between the sulfur compounds among themselves and/or with aromatic hydrocarbons. Given that Toida teaches this mechanism, the combination of Toida and Imura is considered to be

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within the scope of the invention as claimed. Accordingly, the instant claims are not considered to be patentably distinguished from Toida in view of Imura.

31. Arguments regarding the feedstock of Imura are addressed above in the rejection as modified according to the claim amendments.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RENEE ROBINSON whose telephone number is (571)270-7371. The examiner can normally be reached on Monday through Thursday 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Griffin can be reached on (571)272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. R./
Examiner, Art Unit 1774

/Walter D. Griffin/
Supervisory Patent Examiner,
Art Unit 1774